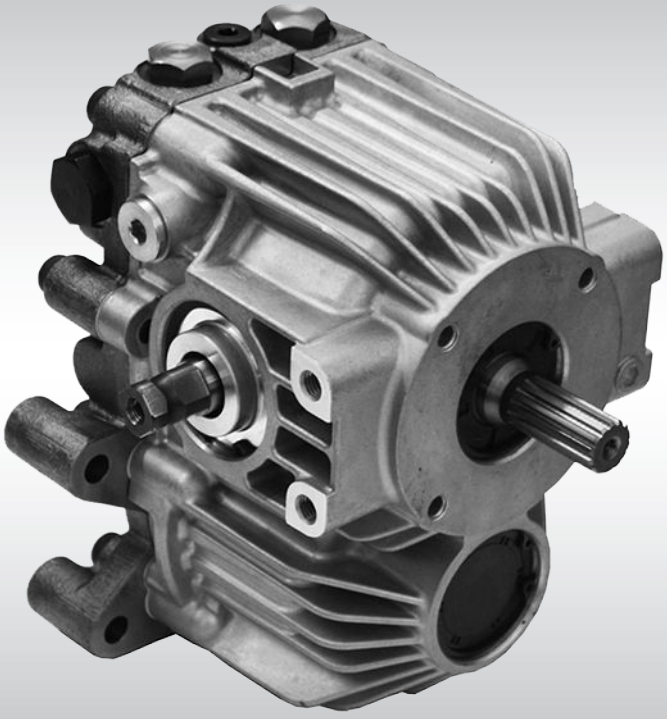
MAKING MODERN LIVING POSSIBLE

Service Manual

LDU 20

Closed Circuit Axial Piston Transmission



Revision History

Table of Revisions

Date	Changed	Rev
March 2014	Danfoss layout	BA
January 2011	First edition	AA

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Introduction

Overview

This manual includes information on the installation, maintenance, and minor repair of LDU 20 pumps. It includes a description of the unit and its individual components, troubleshooting information, and minor repair procedures.

Performing minor repairs may require removal from the vehicle/machine. Thoroughly clean the unit before beginning maintenance or repair activities. Since dirt and contamination are the greatest enemies of any type of hydraulic equipment, follow cleanliness requirements strictly. This is especially important when changing the system filter and when removing hoses or plumbing.

A worldwide network of Danfoss Authorized Service Centers is available for major repairs. Danfoss trains and certifies Authorized Service Centers on a regular basis. You can locate your nearest Authorized Service Center using the distributor locator at www.sauer-danfoss.com.

Warranty

Performing installation, maintenance, and minor repairs according to the procedures in this manual will not affect your warranty. Major repairs requiring the removal of the units center section voids the warranty unless completed by a Danfoss Global Service Partner.

General Instructions

Follow these general procedures.

Remove the unit

Prior to performing major repairs, remove the unit from the vehicle/machine. Chock the wheels on the vehicle or lock the mechanism to inhibit movement. Be aware that hydraulic fluid may be under high pressure and/or hot. Inspect the outside of the pump and fittings for damage. Cap hoses and plug ports after removal to prevent contamination.

Keep it clean

Cleanliness is a primary means of assuring satisfactory pump life, on either new or repaired units. Clean the outside of the pump thoroughly before disassembly. Take care to avoid contamination of the system ports. Cleaning parts using a clean solvent wash and air drying is usually adequate.

As with any precision equipment, keep all parts free of foreign materials and chemicals. Protect all exposed sealing surfaces and open cavities from damage and foreign material. If left unattended, cover the pump with a protective layer of plastic.

Lubricate moving parts

During assembly, coat all moving parts with clean hydraulic fluid. This assures that these parts are lubricated during start-up.

Replace all O-rings and gaskets

Danfoss recommends you replace all O-rings, seals, and gaskets during repair.Lightly lubricate all O-rings with clean petroleum jelly prior to assembly. Grease must be soluable in hydraulic fluid.

Introduction

Secure the unit

For major repair, place the unit in a stable position with the shaft pointing downward. It is necessary to secure the pump while removing and torquing components and fasteners.

Safety Precautions

Always consider safety precautions before beginning a service procedure. Protect yourself and others from injury. Take the following general precautions whenever servicing a hydraulic system.

Unintended machine movement

Warning

Unintended movement of the machine or mechanism may cause injury to the technician or bystanders. To protect against unintended movement, secure the machine or disable/disconnect the mechanism while servicing.

Flammable cleaning solvents

Warning

Some cleaning solvents are flammable. To avoid possible fire, do not use cleaning solvents in an area where a source of ignition may be present.

Fluid under pressure

Warning

Escaping hydraulic fluid under pressure can have sufficient force to penetrate your skin causing serious injury and/or infection. This fluid may also be hot enough to cause burns. Use caution when dealing with hydraulic fluid under pressure. Relieve pressure in the system before removing hoses, fittings, gauges, or components. Never use your hand or any other body part to check for leaks in a pressurized line. Seek medical attention immediately if you are cut by hydraulic fluid.

Personal safety

Warning

Protect yourself from injury. Use proper safety equipment, including safety glasses, at all times.

Hazardous material

Warning

Hydraulic fluid contains hazardous material. Avoid prolonged contact with hydraulic fluid. Always dispose of used hydraulic fluid according to environmental regulations.

Symbols Used in Danfoss Literature

	WARNING may result in injury
	CAUTION may result in damage to product or property
	Non-reusable part, use a new part

Introduction

	External hex head
	Internal hex head
	Lubricate with hydraulic fluid
	Apply grease / petroleum jelly
	Inspect for wear or damage
	Clean area or part
	Be careful not to scratch or damage
	Note correct orientation
	Torque specification
	Press in – press fit
	Measurement required
	Pull out with tool – press fit
	Flatness specification
	Parallelism specification
	Cover splines with installation cylinder
	Mark orientation for reinstallation

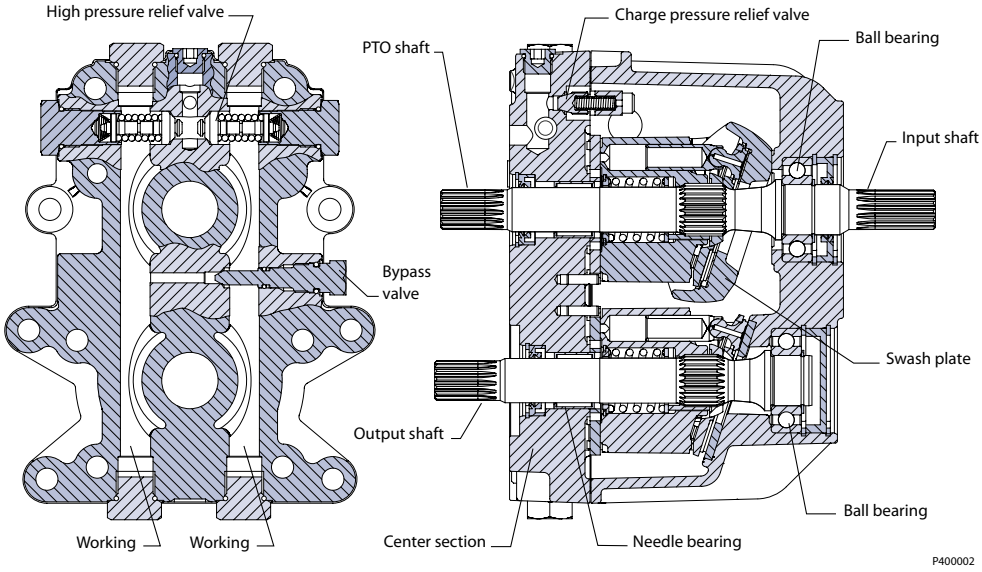
The symbols above appear in the illustrations and text of this manual. They are intended to communicate helpful information at the point where it is most useful to the reader. In most instances, the appearance of the symbol itself denotes its meaning. The legend above defines each symbol and explains its purpose.

General Description

Basic Design

LDU20 is a U-style HST transmission, including a closed circuit variable displacement piston pump with DDC (Direct displacement control) and a fixed motor. LDU20 is specially designed with optimized performance, size, and cost, in order to fulfill the demand of the mobile applications marketplace. This document provides the detailed specifications and features for LDU20.

LDU20 Cross-sectional view



Key Features

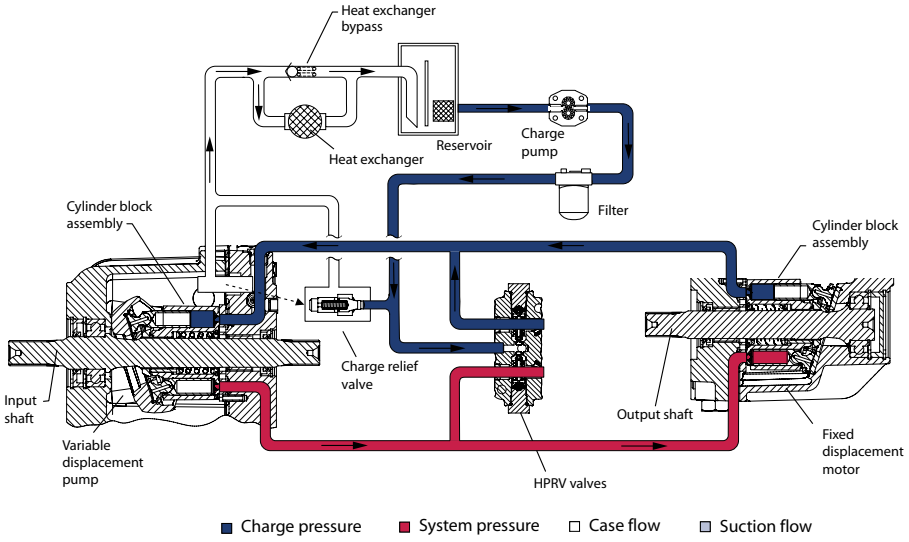
- Easy to use design as Complete Hydrostatic Transmission package for Turf care machine & Compact Utility Tractor of up to 22kw[30PS]
- Compact design
- U-style layout in One housing with Z-shaft configuration
- Available external charge
- Bypass valve for the pulling of the vehicle
- Same shaft center distance as BDU21 85mm…Between pump and motor shaft
- Same drive line design is available between BDU21 and LDU20
- Best in class Efficiency by Female Piston & Male slipper design…Can reach approximately 80% overall efficiency
- Longer life kit, Higher Duty capability in most compact design in this class of HST
- Low operating force
- Serviced by a Worldwide Network of Danfoss

Typical Applications

- Compact utility tractor
- Turf care
- Small agricultural machinery

General Description

System Diagram



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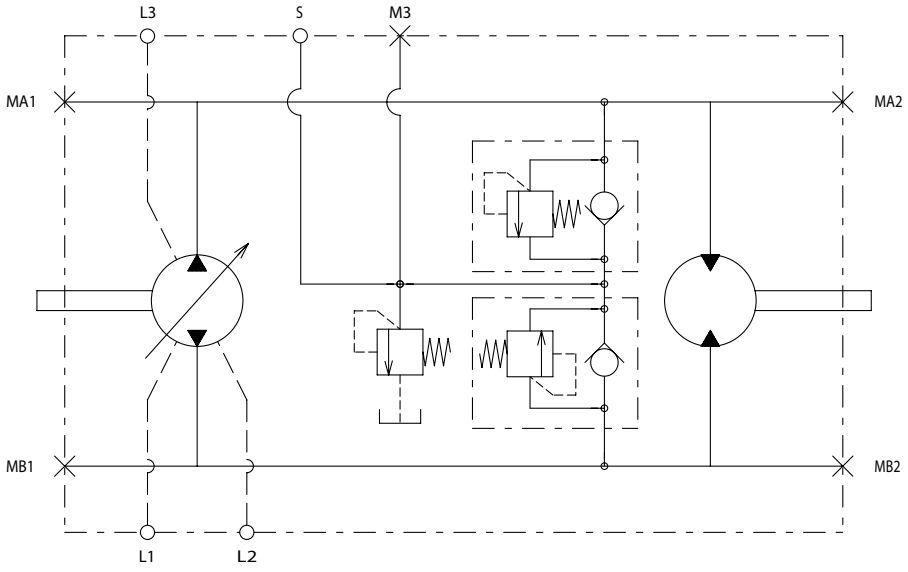
Schematic Diagram



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Operation

HPRV (High Pressure Relief Valve)

LDU20 is equipped with a combination high pressure relief and charge check valve. The high-pressure relief function is a dissipative (with heat generation) pressure control valve for the purpose of limiting excessive system pressures. The charge check function acts to replenish the low-pressure side of the working loop with charge oil. Each side of the transmission loop has a dedicated HPRV valve that is non-adjustable with a factory set pressure. When system pressure exceeds the factory setting of the valve, oil is passed from the high pressure system loop, into the charge gallery, and into the low pressure system loop via the charge check.

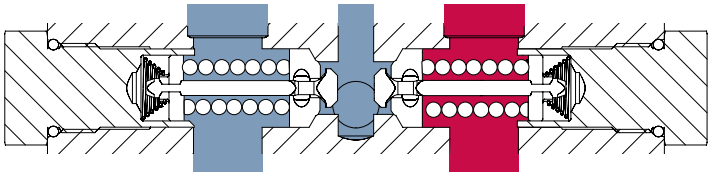
The pump order code allows for different pressure settings to be used at each system port. HPRV valve with orifice is available to gain wider neutral dead-band. When HPRV valves with orifice are used, it is only for High pressure ports when vehicle goes in reverse. The system pressure order code for pumps with only HPRV is a reflection of the HPRV setting.

The system pressure order code for pumps configured with pressure limiter and HPRV is a reflection of the pressure limiter setting.

HPRV settings

HPRV valve without orifice	5 l/min [1.3 US gal/min]
HPRV valve with orifice	17 l/min [4.5 US gal/min]

HPRV (High Pressure Relief Valve)



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Caution

HPRV´s are factory set at a low flow condition. Any application or operating condition which leads to elevated HPRV flow will cause a pressure rise with flow above a valve setting. Consult factory for application review.

Charge Check Relief Valve with Orifice

As an option, LDU20 offers a charge check relief valve with an orifice in order to enlarge the neutral dead-band.

In some applications, it is desirable to use charge check valve with orifice for expanding null dead band, giving both the safety measure to prevent the vehicle movement in the neutral position of the control shaft and easy adjustment of neutral position when connected to vehicle linkage. The orifice connects the working loop, which is a main hydraulic circuit, to a charge circuit. It always allows some internal leakage to ensure the expanding null dead band around neutral position of control shaft. However, it decreases the volumetric efficiency, particularly at high system pressure in the working loop. It is recommended to install the orifice in a specific working loop, which is pressurized when the vehicle moves in reverse. A cross section and characteristics are shown above. The charge check valves with orifice are available with 0.85mm orifice today. This option is allowable for only high pressure port when vehicle goes in reverse.

Operation

Bypass Function

The LDU20 contains a dedicated bypass valve option. The bypass function is activated when the bypass valve is mechanically backed out 3 full turns (maximum). The bypass function allows a machine or load to be moved without rotating the pump shaft or prime mover.

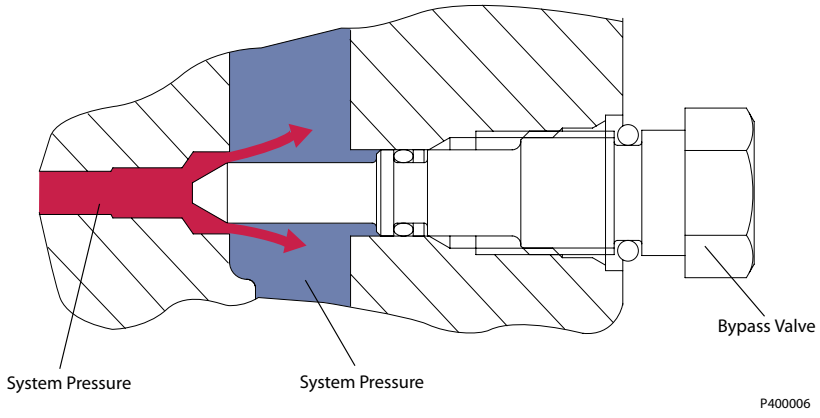
For example; an inoperable vehicle may need to be moved to the service or the repair location, or winched onto a trailer without operating the prime mover.

Caution

Excessive speed or extended movement will damage the transmission.

Avoid excessive speeds and extended load/vehicle movement. Do not move the load or vehicle more than 20 % of maximum speed or for longer than 3 minutes. When the bypass function is no longer needed, reseat the bypass valve to the normal operating position.

Bypass Function



CPRV (Charge Pressure Relief Valve)

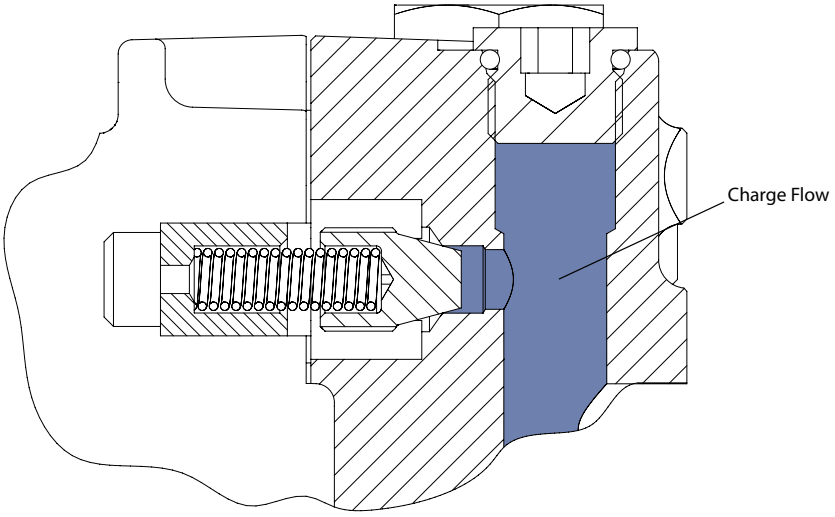
The charge pressure relief valve maintains charge pressure at a designated level above case pressure. The charge pressure relief valve is a direct acting poppet valve which opens and discharges fluid to the HST case when pressure exceeds a designated level. For external charge flow the CPRV is set according to below table. The charge pressure relief valve setting is specified on the model code of the pump.

Charge Pressure Relief Valve settings

	Flow l/min [US gal/min]
LDU 20	10.8 l/min [2 US gal/min]

Operation

Charge Pressure Relief Valve Function



Control

Direct Displacement Control

The LDU20 features Direct Displacement Control (DDC) .The swashplate angle is set directly by a control lever or linkage attached directly to the swashplate trunnion. Control lever movement changes the speed and rotating direction of the motor by increasing or decreasing the swashplate angle.

The control input shaft is configurable on both of left and right hand side of the LDU20.

Control Handle Requirements

Maximum allowable trunnion torque is 79.1 N•m [700 lbf•in]. The approximate torque necessary to rotate the control per 300 bar and 3000 rpm of system operating pressure is 25 N•m with standard valveplate. The actual value will vary due to the influence of pump operating conditions. For mating dimensions, see Installation drawings in LDU20 Technical Information Manual 11071631.

Warning

With no external forces applied to the swashplate trunnion, internal hydraulic forces may not return the swashplate to the neutral position under all conditions of operation.

Operating Parameters

Overview

This section defines the operating parameters and limitations for LDU20 with regard to input speeds and pressures. For actual parameters, refer to Operating Parameters in the Technical Specifications section.

Input Speed

Minimum speed is the lowest input speed recommended during engine idle condition. Operating below minimum speed limits pump's ability to maintain adequate flow for lubrication and power transmission.

Rated speed is the highest input speed recommended at full power condition. Operating at or below this speed should yield satisfactory product life.

Maximum speed is the highest operating speed permitted. Exceeding maximum speed reduces product life and can cause loss of hydrostatic power and braking capacity. Never exceed the maximum speed limit under any operating conditions.

Operating conditions between rated speed and maximum speed should be restricted to less than full power and to limited periods of time. For most drive systems, maximum unit speed occurs during downhill braking or negative power conditions.

Warning

Unintended vehicle or machine movement hazard.

Exceeding maximum speed may cause a loss of hydrostatic drive line power and braking capacity. You must provide a braking system, redundant to the hydrostatic transmission, sufficient to stop and hold the vehicle or machine in the event of hydrostatic drive power loss.

System Pressure

System pressure is the differential pressure between system ports A and B. It is the dominant operating variable affecting hydraulic unit life. High system pressure, which results from high load, reduces expected life. Hydraulic unit life depends on the speed and normal operating, or weighted average, pressure that can only be determined from a duty cycle analysis.

Maximum working pressure - is the highest recommended application pressure. Maximum working pressure is not intended to be a continuous pressure. Propel systems with application pressures at, or below, this pressure should yield satisfactory unit life given proper component sizing.

Maximum pressure is the highest allowable application pressure under any circumstance. Application pressures above maximum working pressure will only be considered with duty cycle analysis and factory approval. Minimum pressure must be maintained under all operating conditions to avoid cavitation.

All pressure limits are differential pressures referenced to low loop (charge) pressure.Subtract low loop pressure from gauge readings to compute the differential.

Input Power

Maximum continuous input power is the highest recommended input power to HST excluding PTO output power.

Charge Pressure

An internal charge relief valve regulates charge pressure. Charge pressure maintains a minimum pressure in the low side of the transmission loop. Charge pressure is the differential pressure above case pressure.

Minimum charge pressure is the lowest pressure safe working conditions allow in the system.

Maximum charge pressure is the highest charge pressure the charge relief adjustment allows, and which provides normal component life.

Charge flow to pump must be sufficient to provide adequate charge pressure.

Case Pressure

Do not exceed rated case pressure under normal operating conditions. During cold start, keep case pressure below maximum intermittent case pressure. Size drain plumbing accordingly.

Operating Parameters

Caution

Possible component damage or leakage

Operation with case pressure in excess of stated limits may damage seals, gaskets, and/or housings, causing external leakage. This condition may also affect performance since charge and system pressure are referenced to case pressure.

Viscosity

Maintain fluid viscosity within the recommended range for maximum efficiency and bearing life. Minimum viscosity should only occur during brief occasions of maximum ambient temperature and severe duty cycle operation. Maximum viscosity should only occur at cold start. Limit speeds until the system warms up. Refer to Fluid specifications in LDU20 Technical Information Manual 11071631.

Temperature

Maintain fluid temperature within the limits shown in the Technical Specifications section of LDU20 Technical Information Manual 11071631. Minimum temperature relates to the physical properties of the component materials. Cold oil will not affect the durability of the pump components, however, it may affect the ability of the pump to provide flow and transmit power. Maximum temperature is based on material properties. Don't exceed it. Measure maximum temperature at the hottest point in the system. Refer to Fluid Specifications in LDU20 Technical Information Manual 11071631.

Ensure fluid temperature and viscosity limits are concurrently satisfied.

Technical Specifications

General Specifications

Design	U-style HST with variable displacement piston pump and fixed motor
Direction of Rotation	Clockwise Counterclockwise
Pipe Connections	Main Pressure Ports: SAE O-ring Boss
Recommended Installation Position	Discretionary: The housing must be filled with hydraulic fluid

Physical Properties

Features		Units	LDU20
Displacement	Pump side1	cm3/rev [in3/rev]	0-20 [0-1.22]
	Motor side		20 [1.22]
Torque at maximum displacement (theoretical)		N•m/bar [lbf•in/1000 psi]	0.32 [195.2]
Mass moment of inertia of rotating components	Pump side	kg•m2 [slug•ft2]	0.000936 [0.00693]
	Motor side		0.000928 [0.00683]
Weight, dry		kg [lb]	14.1 [31.1]
Oil volume	Case only	liter [US gal]	1.1 [0.28]
	With passage	liter [US gal]	1.2 [0.32]
Port Configuration			
High pressure gauge port		SAE O-ring boss	3/4-16 UNF
Charge pressure gauge port		SAE O-ring boss	9/16-18 UNF
Case drain ports		SAE O-ring boss	3/4-16 UNF

Operating Parameters

Features		Units	LDU20
Input speed	Minimum (for full performance)	min-1 (rpm)	500
	Rated		3400
	Maximum		3800
System Pressure	Maximum working	bar [psi]	300 [4350]
	Maximum pressure		345 [5000]
Input power	Maximum working	kw [hp]	22 [29.5]
Charge pressure	Minimum	bar [psi]	5 [73]
Case pressure	Rated	bar [psi]	1 [14.50]
	Maximum		3 [43.5]

Fluid Specifications

Features		Units	LDU20
Viscosity	Minimum	mm2/sec. [SUS]	7 [49]
	Recommended range		12-60 [66-280]
	Maximum		1600 [7500]
Temperature	Minimum	Degrees C [Degrees F]	-40 [-40]
	Recommended range		+82 [+180]

Technical Specifications

Features		Units	LDU20
	Maximum		+104 [+220]
Filtration (recommended minimum)	Cleanliness per ISO 4406		22/18/13
	Efficiency (charge pressure filtration)	b - ratio	b 15-20=75(b 10≥10)
	Efficiency (suction and return line filtration)		b 15-20=75(b 10≥10)
	Rercommended inlet screen mesh size	µm	100-125

Fluid and Filter Maintenance

Fluid and Filter Recommendations

To ensure optimum life, perform regular maintenance of the fluid and filter. Contaminated fluid is the main cause of unit failure. Take care to maintain fluid cleanliness when servicing.

Check the reservoir daily for proper fluid level, the presence of water, and rancid fluid odor. Fluid contaminated by water may appear cloudy or milky or free water may settle in the bottom of the reservoir. Rancid odor indicates the fluid has been exposed to excessive heat. Change the fluid immediately if these conditions occur. Correct the problem immediately.

Inspect vehicle for leaks daily.

Change the fluid and filter per the vehicle/machine manufacturer's recommendations or at these intervals.

We recommend first fluid change occur at 500 hours of operation.

Fluid and Filter Change Interval

Reservoir Type	Max. Oil Change Interval
Sealed	2000 Hours
Breather	500 Hours

Caution

High temperatures and pressures accelerate fluid aging. This may require more frequent fluid changes.

Change the fluid more frequently if it becomes contaminated with foreign matter (dirt, water, grease, etc.) or if the fluid is subjected to temperature levels greater than the recommended maximum. Dispose of used hydraulic fluid properly. Never reuse hydraulic fluid.

Change filters when changing fluid or when the filter indicator directs. Replace all fluid lost during filter change

Warning

Hydraulic fluid contains hazardous material. Avoid contact with hydraulic fluid. Always dispose of used hydraulic fluid according to state, and federal environmental regulations. Never reuse hydraulic fluid.

Pressure Measurements

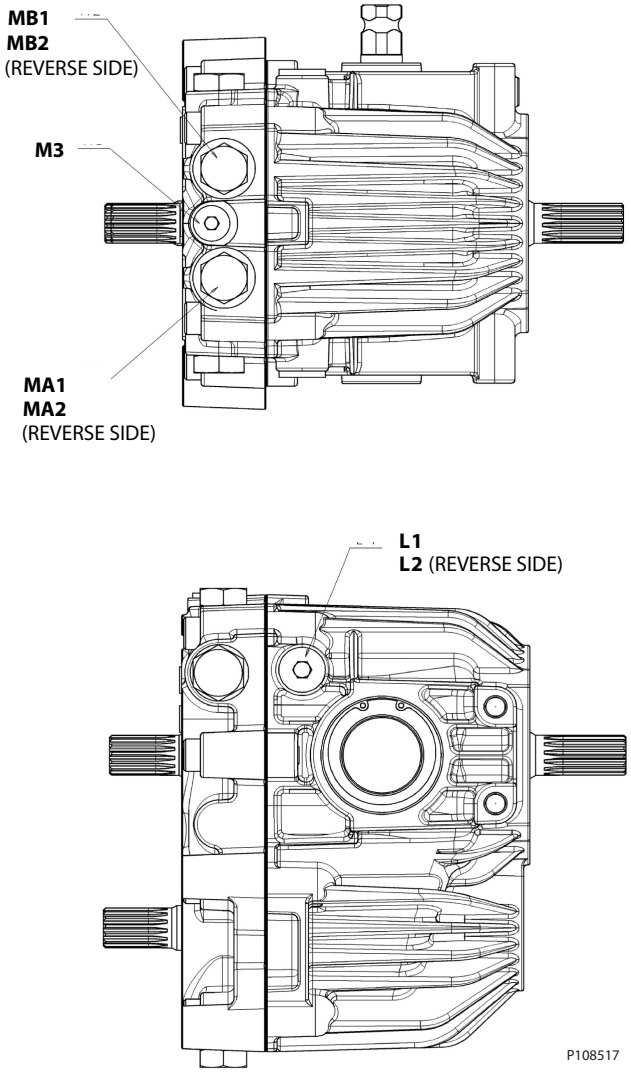
Port Locations and Gauge Installation

The following table and drawing show the port locations and gauge sizes needed.

Port Information

Port Identifier	Port Size	Wrench Size	Pressure Obtained	Gauge Size, bar [psi]
L1, L2	3/4-16 UNF	5/16 internal hex	Case Drain	10 [100]
MA1, MA2, MB1, MB2	3/4-16 UNF	7/8 hex wrench	System Pressure	500 [5000]
M3	9/16-18 UNF	1/4 internal hex	Charge Pressure	50 [1000]

Port Locations



Initial Startup Procedure

Startup Procedure

Always follow this procedure when starting up a new LDU20 installation or when the transmission has been removed.

Warning

This service procedure may require disabling a vehicle/machine (raising the wheels off the ground, or disconnecting the work function) to prevent injury to the technician and bystanders. Take the necessary safety precautions.

1. Before installing the transmission, inspect the units for possible damage incurred during shipping and handling.
2. Make certain all system components (reservoir, hoses, valves, fittings, heat exchanger, and so forth) are clean before filling with fluid.
3. Install new system filter element(s) if necessary. Check that inlet line fittings are properly tightened and free of air leaks.
4. Install the transmission. Install a 50 bar [1000 psi] gauge in the charge pressure gauge port M3.
5. Fill the housing by adding filtered hydraulic fluid to the upper case drain port.
6. Fill the reservoir with hydraulic fluid of the recommended type and viscosity. Use a 10-micron filler filter. Ensure construction plug is closed after filling is complete.
7. Place the control lever in neutral, The control linkage must be disconnected from the transmission during initial start up.

   Caution

   After start-up the fluid level in the reservoir may drop due to system components filling with fluid. Damage to hydraulic components may occur if the fluid supply runs out. Ensure reservoir remains full of fluid during start-up.

   Air entrapment in oil under high pressure may damage hydraulic components. Check carefully for inlet line leaks.

   Do not run at maximum pressure until system is free of air and fluid has been thoroughly filtered.
8. Use a common method to disable the engine to prevent it from starting. Crank the starter for several seconds. Do not to exceed the engine manufacturer's recommendation. Wait 30 seconds and then crank the engine a second time as stated above. This operation helps remove air from the system lines. Refill the reservoir to recommended full oil level.
9. When the gauge begins to register charge pressure, enable and start engine. Let the engine run for a minimum of 30 seconds at low idle to allow the air to work itself out of the system. Check for leaks at all line connections and listen for cavitation. Check for proper fluid level in reservoir.
10. When adequate charge pressure is established (as shown in model code), increase engine speed to normal operating rpm to further purge residual air from the system.
11. Shut the off engine. Connect the control linkage. Start the engine, checking to be certain the pump remains in neutral. Run the engine at normal operating speed and carefully check for forward and reverse control operation.
12. Continue to cycle between forward and reverse for at least 5 minutes to bleed all air and flush system contaminants out of the system loop.

    Charge pressure may decrease slightly during forward or reverse operation.
13. Check that the reservoir is full. Remove charge pressure gauge and cap charge pressure port (M3). The transmission is now ready for operation.

Troubleshooting

Overview

This section provides general steps to follow if you observe undesirable system conditions. Follow the steps listed until you solve the problem. Some of the items are system specific. We reference the section in this manual of more information is available. Always observe the safety precautions listed in the Introduction section and any precautions related to your specific equipment.

System Operating Hot

Item	Description	Action
Oil level in reservoir.	Insufficient hydraulic fluid does not meet cooling demands of system.	Fill reservoir to proper level.
Heat exchanger.	Heat exchanger is not sufficiently cooling the system.	Check air flow and input air temperature for heat exchanger. Clean, repair or replace heat exchanger.
Bypass valve	Leakage through by-pass line with high speed operation may cause temperature increase	Inspect bypass valve and replace as necessary. Check that bypass valve is tightened.
System relief pressure settings	If the system relief valves are worn, contaminated, or valve settings are too low, the relief valves get overworked.	Verify settings of high pressure relief valves and adjust or replace as necessary.
System pressure.	Frequent or long term operation over system relief setting creates heat in system.	Measure system pressure. If pressure is too high, reduce loads.

Transmission Operates Normally in One Direction Only

Item	Description	Action
Control linkage	Control linkage is operating improperly.	Repair/replace linkage
Interchange charge check/ HPRVs	Interchanging the charge check/HPRVs will show if the problem is related to the valve function.	If the problem changes direction, replace the defective valve.
Bypass valve is open	Open bypass valve will cause either direction to be inoperative	Close/repair bypass function

System will not Operate in Either Direction

Item	Description	Action
Oil level in reservoir	Insufficient hydraulic fluid to supply system loop.	Fill reservoir to proper level.
Bypass valve is open	If bypass valve is open, the system loop becomes depressurized.	Close bypass valve
Charge pressure with pump in neutral	Low charge pressure insufficient to recharge system loop	Measure charge pressure with the pump in neutral. If pressure is low, go to next step.
System pressure	Low system pressure does not provide enough power to move load.	Measure system pressure. Continue to next step.
Charge check/HPRVs	Low system pressure does not provide enough power to move load.	Repair or replace charge check/HPRVs
Control linkage	Linkage operating improperly.	Repair/replace linkage

System Noise or Vibration

Item	Description	Action
Reservoir oil level	Low oil level leads to cavitation.	Fill reservoir.
Aeration of the oil/pump inlet vacuum	Air in the system decreases efficiency of units and controls. Air in the system is indicated by excessive noise in pump, foaming in oil, and hot oil.	Find location where air is entering into the system and repair. Check that inlet line is not restricted and is proper size.

Troubleshooting

Item	Description	Action
Cold oil	If oil is cold, it may be too viscous for proper function and pump cavitates	Allow the oil to warm up to its normal operating temperature with engine at idle speed.
Pump inlet vacuum	High inlet vacuum causes noise/cavitation.	Check that inlet line is not restricted and is proper size. Check filter.
Shaft couplings	A loose shaft coupling causes excessive noise.	Replace loose shaft coupling.
Shaft alignment	Misaligned pump and prime mover shafts create noise.	Align shafts.
Charge check/HPRVs	Unusual noise may indicate sticking valves. Possible contamination.	Clean/replace valves and test pump.

Sluggish System Response

Item	Description	Action
Oil level in reservoir	Low oil level causes sluggish response.	Fill reservoir.
Charge check/HPRVs	Incorrect pressure settings affects system reaction time.	Replace charge check/HPRVs
Low prime mover speed	Low engine speed reduces system performance	Adjust engine speed.
Air in system	Air in system produces sluggish system response	Fill tank to proper level. Cycle system slowly for several minutes to remove air from system.
Pump inlet vacuum	Inlet vacuum is too high resulting in reduced system pressure.	Measure charge inlet vacuum. Inspect line for proper sizing. Replace filter. Confirm proper bypass operation.
Control linkage	Linkage operating improperly	Repair or replace control linkage

Required Tools and Standard Procedures

Required Tools

The service procedures described in this manual can be performed using common mechanic's hand tools. Special tools, if required, are shown. When testing system pressure, calibrate pressure gauges frequently to ensure accuracy. Use snubbers to protect gauges.

Standard Procedures

Caution

Contamination can damage internal components and void the warranty. Take precautions to ensure system cleanliness when removing and reinstalling system lines.

1. With the prime mover off, thoroughly clean all dirt and grime from the outside of the transmission. Ensure the surrounding areas are clean and free of contaminants such as dirt and grime.
2. If removing the transmission, tag each hydraulic line connected to the transmission. If you disconnect hydraulic lines, plug each open port to keep dirt and contamination out of the transmission.
3. Inspect the system for contamination. Look at the hydraulic fluid for signs of system contamination, such as oil discoloration, foam in the oil, sludge, or small metal particles.
4. Remove the transmission.

   Caution

   Be careful not to damage solenoids and electrical connections when using straps or chains to remove transmission from machine.

5. Perform transmission function test.
6. Before re-installing the transmission on the machine, test for leaks , drain the system, flush all lines, replace all filters, and fill with new hydraulic fluid.

Charge Check/HPRV Adjustments

The Charge Check/HPRV combines the charge check and high pressure relief functions. Whenever you replace a Charge Check/HPRV, operate the vehicle/machine through its full range of functions to ensure proper pump operation. The Charge Check/HPRVs are preset at the factory. No adjustment is possible.

Checking for proper charge check/HPRV operation

If you suspect Charge Check/HPRV malfunction, swap valves and test operation. If the symptoms switch direction, replace the faulty valve.

Minor Repair

Shaft Seals

Removal

1. Using a snap ring pliers, remove retaining ring (F125, F215, H125, H215).
2. Use a slide-hammer style puller to remove seal (F115, F210, H115, H210). Be careful not to damage the shaft or seal bore when removing the seal. Discard seal.

Inspection

Inspect retaining ring for wear or damage.

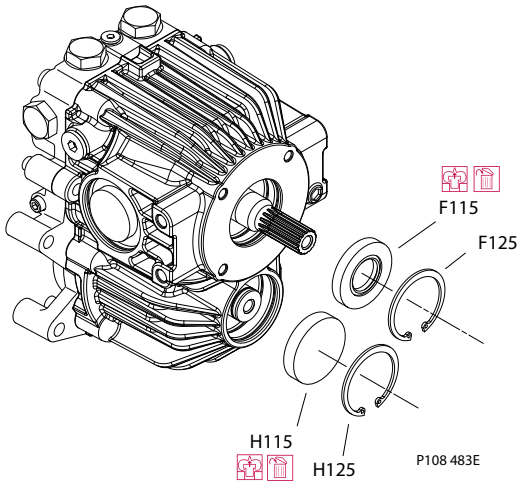
Assembly

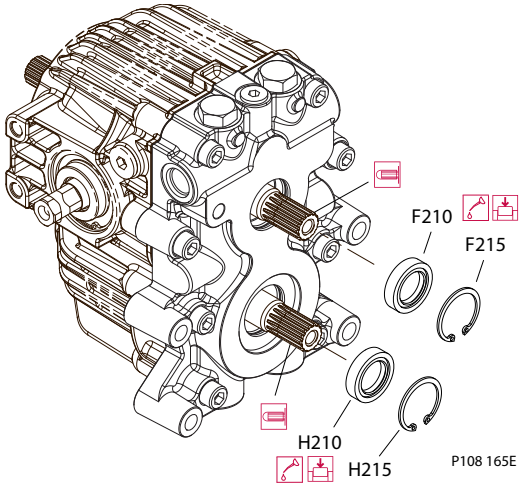
1. Lubricate inside diameter of new seal. Cover the shaft splines with protective sleeve to avoid damaging the seal during installation.
2. Using a seal installation tool, start the seal into the housing bore. Hand press the seal the rest of the way into the housing bore. Ensure the seal clears the retaining ring groove in the housing. Remove the protective sleeve from the shaft.

   Do not press seal beyond snap ring groove. Stop pressing just when you have room to install the retaining ring into the bore.
3. Using a snap ring pliers, install retaining ring (F125, F215, H125, H215).

Minor Repair

Shaft Seals





Charge Check/HPRV

The high pressure relief and charge check valve assembly may be removed for cleaning and replacement of the O-rings. These valves are factory set and are not field adjustable. Refer to the pump model code for the factory setting when ordering replacements.

Removal

1. Using an 24 mm hex wrench, remove the valve seat plugs (N120, P120).
2. Carefully lift the valve (N110, P110) and spring (N100, P100) assemblies from the center section using a magnet.

Inspection

Inspect the valves and mating seats in the valve seat plugs (N120, P120) for damage or foreign material.

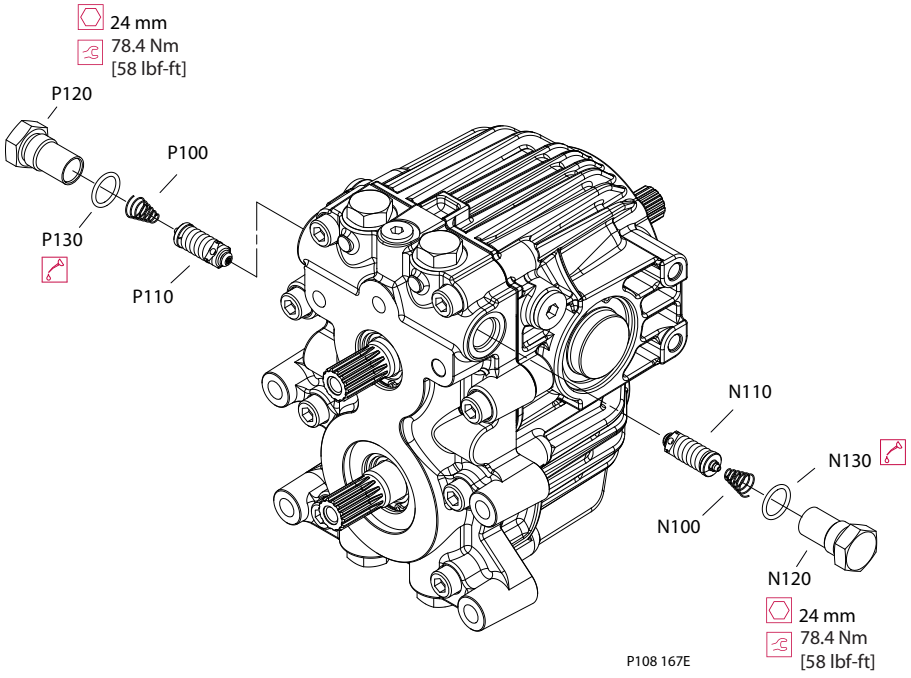
Reassembly

1. Lubricate and install new O-rings (N130, P130) on valve seat plug (N120, P120).

Minor Repair

2. Verify that the conical springs (N100, P100) are properly retained on the check relief valves (N110, P110). Install the valve assemblies into the center section. Ensure each valve assembly moves freely in its bore.
3. Install the valve seat plugs into the center section and torque to 78.4 N•m [58 lbf•ft].
4. Operate vehicle/machine through full range of controls to ensure proper operation. Check for leaks.

Charge Check/HPRV



Bypass Valve

Removal

Using a 17mm hex wrench, remove the bypass valve cartridge. Discard O-ring (M110, M130) and backup ring (M120).

Inspection

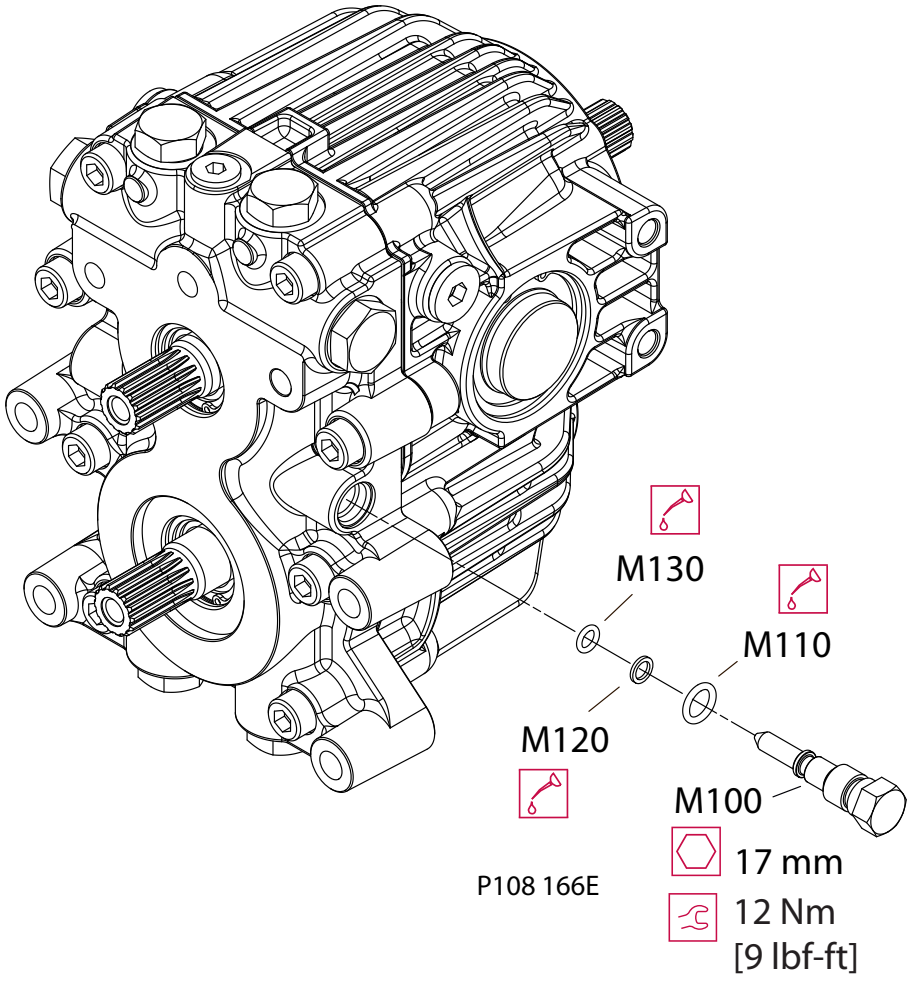
Inspect cartridge. Replace as necessary.

Reassembly

1. Lubricate and install new O-ring (M110, M130) and backup ring (M120) onto cartridge.
2. Install the bypass valve cartridge using a 17mm hex wrench. Torque to 12 N•m [9lbf•ft].

Minor Repair

Bypass Valve

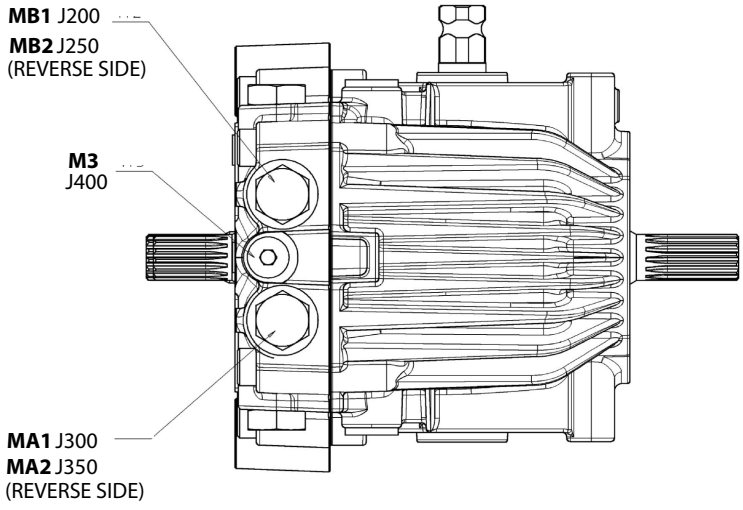


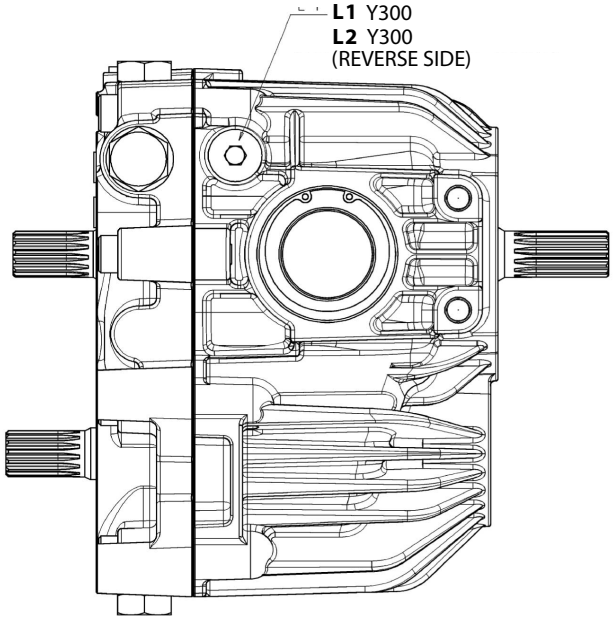
Torque Chart

Plug Size and Torque Chart

Item	O-ring Plug	Wrench Size	Torque N•m [lbf•ft]
J200, J250, J300, J350	3/4-16 UNF	7/8 hex wrench	78.4 [57.8]
J400	9/16-18 UNF	1/4 internal hex	35 [25.8]
Y300	3/4-16 UNF	5/16 internal hex	39.2 [29]

Plugs





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